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ABSTRACT

A project was conducted: (1) to identify instructional objectives in the Louisiana vocational agriculture curriculum that contain a substantial amount of mathematical concepts; and (2) to determine the amount of time spent in vocational agriculture programs in the state on agricultural instruction involving mathematics. Research methodology included an examination of the curriculum guide to identify objectives in agriculture that included mathematics, and a survey of a sample of 150 agriculture teachers through a written questionnaire (78 percent return). The study found that a substantial number of mathematics-related instructional objectives are included in the vocational agriculture curriculum and are being taught in vocational agriculture programs. The study also found that the curriculum contains mathematics-related objectives in both level 1 and level 2. The area of agricultural mechanics had the greatest number of mathematics-related competencies. The study recommended that modules containing mathematical problems related to the identified objectives should be developed as a supplement to the curriculum guide. (Matrixes of agriculture-mathematics competencies are included in the report.) (KC)

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ED308383

Vocational Education Research

Identification of Competencies Taught in Vocational Agriculture Programs in Louisiana that Include Mathematical Instruction

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LOUISIANA DEPARTMENT OF EDUCATION

WILMER S. CODY
State Superintendent

IDENTIFICATION OF COMPETENCIES TAUGHT IN VOCATIONAL AGRICULTURE PROGRAMS IN LOUISIANA THAT INCLUDE MATHEMATICAL INSTRUCTION

PROJECT DIRECTOR:

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School of Vocational Education

Louisiana State University

Funded by
The State of Louisiana
Department of Education
Office of Vocational Education

Institution Name Louisiana State University

Date December 16, 1988

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Don R Wood

Don Wood
Assistant Superintendent
Vocational Education

FOREWORD

This research report identifying math-related competencies taught in vocational agriculture programs was produced as a result of a project funded by the Louisiana State Department of Education to Louisiana State University, Baton Rouge, Louisiana. The results of this project were obtained through a cooperative effort between the research staff at Louisiana State University and high school vocational agriculture and math teachers.

An extensive review of the state-adopted curriculum guide for the Basic Program of Vocational Agriculture in Louisiana (Bulletin 1690-I,II & III) was performed by the project staff to determine agricultural objectives that include mathematical instruction. A substantial amount of overlapping subject matter was discovered and is the focus of this research report.

An outcome of this research effort will be an increased awareness of the similarity between the objectives taught in high school mathematics and vocational agriculture. The results are important to teacher educators, state department personnel and vocational teachers as they seek to improve instruction in vocational education courses within the state.

Wilmer S. Cody
State Superintendent of Education

IDENTIFICATION OF COMPETENCIES TAUGHT IN THE VOCATIONAL AGRICULTURE PROGRAM IN LOUISIANA THAT INCLUDE MATHEMATICAL INSTRUCTION

In the past five years, numerous educational reports have been released resulting in a nationwide reform movement in American education. An almost universal theme among these reform reports is an increased attention towards the improvement of the "basics" at the elementary and secondary school levels. Most often this increased attention has resulted in revisions of high school curricula to include additional courses in the basics. For example, in the area of mathematics, some states, including Louisiana, now require every student to pass Algebra I to receive a high school diploma.

As the number of required courses has increased, the number of elective courses available to the student has decreased. In most states, vocational education courses are considered as elective courses. Consequently, enrollments in vocational education have decreased as the number of required high school courses has increased.

Declining enrollments in vocational agriculture are a problem in Louisiana and across the nation. Some vocational agriculture departments have lost as many as 50% of their sophomore students because of increases in math, science, and foreign language requirements. Coleman Harris, Executive Secretary of the National Future Farmers of America (FFA), attributes the decline to the heavier load which makes it tough for those who want to schedule such options as band,

chorus, fine arts, or vocational agriculture.

In the past, little consideration has been given to the potential for teaching basic competencies in other than traditional basic courses. Student competence in mathematics was supposed to be enhanced by additional and more rigorous mathematics courses. However, the educational reform movement is falling short of the goal according to the National Science Board Commission on Precollege Education in Mathematics, Science, and Technology. In their report, Educating Americans for the 21st Century, the Commission finds:

> For the many students in secondary school who are not specially talented in mathematics and not headed for careers in science or technology, current programs are a source of discouragement, anxiety and repetition in a dull "basic skills" program which serves them poorly. We cannot ignore the needs of this large and important group. Computers, as mathematical tools and media of instruction, offer a fresh window into mathematics for them. (p. 10)

Vocational students are a part of this large and important group. The Commission specifically studied the impact of the curricular reform movement in mathematics upon vocational education and concluded the following:

> We believe there is one serious area in which the nation needs more data for the development of an appropriate mathematics curriculum. Namely, what are the needs, in terms of mathematical skills, of the students who seek technical vocational employment without going on to further schooling? Furthermore, what are the mathematical needs of students going on to technical or vocational schools? Although we do not know the answer, we believe the new curriculum will do at least as good a job as the existing one. A conference or meeting to explore this area would be an excellent idea and would complement our work. (p. 15)

Identifying necessary mathematical skills and appropriate delivery methods for those skills must be addressed by both academic and vocational educators. In some states vocational educators have documented the teaching of basic mathematical skills in vocational educational courses and have pursued substitute credit when it can be demonstrated that students are learning mathematics in an applied setting. For example, in Oklahoma a school may waive a unit of credit in mathematics providing a student completes three units of vocational agriculture.

Decisions to allow substitute credit of vocational classes for required basic courses such as mathematics can only be made when strong evidence exists that students are learning the same basic concepts in the vocational courses as are being taught in the traditional basic courses. Through this research project, evidence was gathered concerning mathematical concepts taught in vocational agriculture programs in Louisiana.

PURPOSE and OBJECTIVES

The purpose of this project was to identify instructional objectives in the Basic Program of Vocational Agriculture in Louisiana which contain a substantial amount of mathematical concepts and to determine the amount of time spent in vocational agriculture programs in Louisiana on vocational agriculture instruction that involves mathematics. The project involved an examination of the Ag I and Ag II

curriculum by vocational agriculture teachers and high school math teachers to identify the math-related instructional objectives. In order to achieve the foregoing purpose, the following objectives served as guidelines in the performance of the project.

1. To determine those agricultural objectives which include or require concepts taught in high school mathematics courses.
2. To determine the amount of time spent teaching agricultural objectives that include a substantial amount of math-related instruction.

PROCEDURE

To accomplish the objectives previously outlined, the basic curriculum guide for agriculture was examined to identify possible objectives in agriculture that included mathematics. The Basic Program of Vocational Agriculture in Louisiana (Bulletin 1690, Vols. I, II, III) was used as the source for identifying agricultural objectives taught in Louisiana vocational agriculture programs. This curriculum guide was published in 1983 by the Office of Vocational Education, Louisiana Department of Education, and is used in all programs throughout the state. This basic program of studies, also referred to as Vocational Agriculture I and Vocational Agriculture II, is the foundation for more

specialized training at the 11th and 12th grade levels. Major emphasis at the 9th and 10th grade levels is placed on agricultural sciences, leadership and exploratory work experiences in agricultural production and agribusiness occupations (State Department of Education, 1980).

Two groups of knowledgeable personnel assisted in the identification of the math-related objectives. Input from a sample of Louisiana vocational agriculture teachers was sought to determine math-related instructional objectives and time spent on math-related instruction. Two-hundred forty eight vocational agriculture teachers comprised the population from which the research sample was drawn. A sample size of 150 was determined using the formula for calculating the sample size needed when the size of the population is known and the response measure dichotomous as discussed in Educational and Psychological Measurement by Krejcie and Morgan (1970). The formula was calculated using a 95% confidence level for the table value of chi-square and 0.05 as the degree of accuracy expressed as a proportion. A select sample of 15 Louisiana math teachers was asked to verify the appropriateness of the objectives identified as math-related.

A survey instrument was developed, validated, field tested, and administered to the sample of vocational agriculture teachers. The teachers were asked to determine if the listed objectives included mathematical instruction and to indicate the amount of time spent teaching the objectives.

RESULTS

Useable information was obtained from 117 respondents or 78% of the sample. A total of 24 instructional objectives in the Basic Program of Vocational Agriculture in Louisiana was identified as requiring mathematical skills. Lesson topics and specific instructional objectives are listed in Table 1 along with the type of mathematical skills required for mastering the objective. The following types of mathematical skills were considered:

1. Whole numbers
2. Fractions
3. Decimals
4. Percentages
5. Ratios
6. Interpreting tables, charts, and graphs
7. Interpreting scale drawings
8. Making measurements
9. Estimation

Using whole numbers and fractions are required for all of the 24 agricultural instructional objectives. The next most often used mathematical skill is the ability to make estimates of the answers for mathematical operations performed. Objectives in the instructional area of agricultural mechanics commonly involve the use of measurements and the ability to interpret scale drawings in addition to using whole numbers and fractions. Thirteen different lessons that are a part of the Basic Program of Vocational Agriculture in Louisiana require mathematical skills.

Table 1
Type of Mathematical Skills Required for Mastering Agricultural Instructional Objectives in the Basic Program of Vocational Agriculture in Louisiana

Agricultural Objective	Category of Mathematical Skill								
	Whole Numbers	Fractions	Decimals	Percentages	Ratios	Tables, Charts Graphs	Scale Drawings	Measurement	Estimation
Calculate the straight-line method of depreciation	X	X	X	X					X
Complete a record book exercise for the Basic Experience Program	X	X	X	X					X
Complete a record book exercise for the Ownership Experience Program	X	X	X	X					X
Complete a record book exercise for the Placement/Directed Lab Experience Program	X	X	X	X					X
Distinguish between sound and unsound SOEP plans									X
Prepare a financial plan for obtaining facilities	X	X	X	X		X			X
Identify procedures for financing ownership programs	X	X	X	X					X

Table 1 (continued)

Agricultural Objective	Category of Mathematical Skill								
	Whole Numbers	Fractions	Decimals	Percentages	Ratios	Tables, Charts Graphs	Scale Drawings	Measurement	Estimation
Classify soil samples using the textural triangle as a guide	X	X	X	X	X	X			X
Formulate a liming schedule for various crops	X	X	X	X	X	X			X
Explain the fertilizer ratio of 5-10-5 grade	X	X		X	X				X
Demonstrate the proper use of measuring & marking instruments	X	X	X				X	X	
Calculate nail length	X	X						X	X
Describe the division of a rule or tape	X	X			X			X	
Calculate square feet	X	X			X			X	X
Describe the methods of determining lumber dimension	X	X			X	X		X	
Describe Ohm's Law	X	X	X						X

Table 1 (continued)

Agricultural Objective	Category of Mathematical Skill								
	Whole Numbers	Fractions	Decimals	Percentages	Ratios	Tables, Charts Graphs	Scale Drawings	Measurement	Estimation
Explain how electrical power is measured	X	X	X						
Explain how electrical energy is measured	X	X	X						
Calculate board feet	X	X			X				X
Demonstrate the method for completing a bill of materials	X	X	X			X			X
Calculate the pitch of a roof	X	X			X	X	X	X	X
Demonstrate laying out a common rafter	X	X			X	X	X	X	X
Demonstrate the procedure for rafter ridge allowances and overhang	X	X			X	X	X	X	X
Use the square method to balance a ration	X	X	X	X	X				X

Table 2
Lesson Topics and Specific Instructional Objectives in the Basic Program of Vocational Agriculture that Require Mathematical Skills

Lesson Topic	Specific Instructional Objective	Hours Spent Teaching Lesson
Record Keeping as Applied to Supervised Occupational Experience Programs	Calculate the straight-line method of depreciation	6.2
	Complete a record book exercise for the Basic Experience Program	
	Complete a record book exercise for the Ownership Experience Program	
	Complete a record book exercise for the Placement/Directed Lab Experience Program	
Building the Supervised Occupational Experience	Distinguish between sound and unsound SOEP plans	2.0
Determine Facilities for Obtaining Individual Work Experience	Prepare a financial plan for obtaining facilities	2.2
	Identify procedures for financing ownership programs	
Physical Properties of Soil	Classify soil samples using the textural triangle as a guide	2.8
Liming to Correct Soil Acidity	Formulate a liming schedule for various crops	2.0

Table 2 (continued)

Lesson Topic	Specific Instructional Objective	Hours Spent Teaching Lesson
Organic and Inorganic Fertilizers	Explain the fertilizer ratio of a 5-10-5 grade	2.4
Identification, Care, Storage, and Proper Use of Hand Woodworking Tools	Demonstrate the proper use of measuring and marking instruments	3.0
Nails, Screws, and Fasteners	Calculate nail length	1.5
Basic Mathematics in Carpentry	Describe the divisions of a rule or tape	4.0
	Calculate square feet	
	Describe the methods of determining lumber dimension	
Electrical Terms, Equipment, Meter Reading and Computation of Cost of KW Hours	Describe Ohm's Law	4.5
	Explain how electrical power is measured	
	Explain how electrical energy is measured	
Project Planning	Calculate board feet	3.1
	Demonstrate the method for completing a bill of materials	
Cutting Rafters	Calculate the pitch of a roof	3.5
	Demonstrate laying out a common rafter	

Table 2 (continued)

Lesson Topic	Specific Instructional Objective	Hours Spent Teaching Lesson
	Demonstrate the procedure for rafter ridge allowances and overhang	
Preparation of Rations	Use the square method to balance a ration	2.8
	Total Hours of Math-Related Instruction	40.0

A summary of the time spent in teaching the agricultural objectives that require mathematical skills is presented in Table 2. Vocational agriculture teachers report spending an average of forty hours, the equivalent of eight weeks of instructional time, on topics where mathematics is being used by or taught to the students.

A summary of the allocated instructional time for Vocational Agriculture I as established in the document, Vocational Agriculture/Agribusiness Program Planning (Bulletin No. 1570) is shown in Table 3 along with the average hours of math-related instruction reported by the teachers. A summary of the allocated instructional time for Vocational Agriculture II is shown in Table 4 along with the average hours of math-related instruction reported by the teachers. The basic curriculum is divided into nine subject matter categories for each year of instruction. Additionally, hours are set-aside for local options by the teacher to better meet student and community needs. Math-related instruction as a percentage of allocated hours is also shown in Tables 3 and 4.

The greatest percentage of allocated hours spent in math-related instruction is in the instructional area of agricultural mechanics. Teachers reported spending 13 hours of instructional time teaching math-related instructional objectives in Vocational Agriculture I and 6.6 hours in Vocational Agriculture II.

Five instructional areas, plant science, career

Table 3
Allocated Instructional Time and Math-Related Instructional Time by Subject Matter Areas for Vocational Agriculture I of the Basic Program of Vocational Agriculture in Louisiana

Instructional Area	Vocational Agriculture I		
	Hours of Allocated Instruction	Hours of Math-Related Instruction	Percent of Allocated Hours
Soil Science	16	4.8	30%
Plant Science	20	0	0%
Animal Science	24	0	0%
Agricultural Mechanics	29	13.0	45%
Orientation to Vo-Ag	13	6.2	48%
Career Information	6	0	0%
Agricultural Leadership	28	0	0%
Local Option[a]	34	6.0	18%
TOTAL	170	30.0	

[a] In addition to the instructional areas included in Vocational Agriculture I, additional hours are allocated to be used as a local option to better meet student and community needs.

Table 4
Allocated Instructional Time and Math-Related Instructional Time by Subject Matter Areas for Vocational Agriculture II of the Basic Program of Vocational Agriculture in Louisiana

Instructional Area	Vocational Agriculture I		
	Hours of Allocated Instruction	Hours of Math-Related Instruction	Percent of Allocated Hours
Soil Science	15	2.4	16%
Plant Science	17	0	0%
Animal Science	15	2.4	16%
Agricultural Mechanics	28	6.6	24%
Orientation to Vo-Ag	10	4.2	42%
Career Information	8	0	0%
Agricultural Leadership	15	0	0%
Environmental Protection	6	0	0%
Energy Conservation	4	0	0%
Local Option[a]	52	12.0	23%
TOTAL	170	27.6	

[a] In addition to the instructional areas included in Vocational Agriculture II, additional hours are allocated to be used as a local option to better meet student and community needs.

information, agricultural leadership, environmental protection and energy conservation, were perceived by the teachers as containing no competencies that were math-related. The percentage of allocated time for these two areas for Vocational Agriculture I and II is 17% of the total instructional time.

Overall, the teachers reported that approximately 17 percent (18% Vo-Ag I; 16% Vo-Ag II) of the instructional time spent in teaching vocational agriculture in Louisiana is spent on math-related instruction. Implications of the findings for vocational agriculture programs in Louisiana are discussed in the conclusions and recommendations that follow.

CONCLUSIONS/RECOMMENDATIONS

The following conclusions and recommendations are made on the basis of this research study.

Conclusions

1. A substantial number of math-related instructional objectives are included in the Basic Program of Vocational Agriculture in Louisiana and are being taught in vocational agriculture programs.
2. The Basic Program of Vocational Agriculture in Louisiana contains math-related objectives in both levels of instruction, Vocational Agriculture I and Vocational Agriculture II.
3. The instructional area, agricultural mechanics, of the Basic Program of Vocational Agriculture in Louisiana is

where the greatest number of math-related competencies are found and where the greatest math-related instruction is occurring.

Recommendations

1. In this study only the basic curriculum (Vo-Ag I and II) was examined. A similar study should be conducted for the advanced curriculum (Vo-Ag III and IV).
2. Modules that emphasize mathematics principles and activities that include mathematical problems related to the identified objectives should be developed as a supplement to the Basic Program of Vocational Agriculture.

REFERENCES

Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30, 607-610.

National Science Board Commission on Precollege Education in Mathematics, Science, and Technology (1982). Educating Americans for the 21st Century. National Science Foundation, Washington, D.C.

State Department of Education (1980). Vocational Agriculture/Agribusiness Program Planning. Bulletin No. 1570, Baton Rouge, LA.

A P P E N D I X I

Survey Instrument

IDENTIFICATION OF MATH-RELATED INSTRUCTIONAL OBJECTIVES IN THE BASIC PROGRAM OF VOCATIONAL AGRICULTURE IN LOUISIANA
(Vocational Agriculture Survey)

The purpose of this survey instrument is to collect information to identify instructional objectives taught in Vocational Agriculture I and Vocational Agriculture II (The Basic Program of Vocational Agriculture in Louisiana) that include mathematical instruction. The basic curriculum guide was reviewed by the research project staff and possible math-related lesson topics and objectives are listed on the questionnaire. Please rate each objective as it relates to the following:

1. Agree or Disagree that the lesson topic/objective is math-related
2. Estimate time spent teaching the lesson topic if math-related; (estimate time to the nearest 1/2 hour, consider one class period as 1 hour)

Please add any math-related lesson topics or objectives that you teach that are not listed on the questionnaire.

Lesson Topic/Objective	Requires Math Skills		Time Spent Teaching Lesson
	Agree	Disagree	
EXAMPLE 1. Calculate straight-line depreciation 2. State the primary aim of the FFA	✓	✓	(2) hours
UNIT: Orientation to Vocational Agriculture			
Record Keeping as Applied to Supervised Occupational Experience Programs			( ) hours
Calculate the straight-line method of depreciation			
Complete a record book exercise for the Basic Experience Program			
Complete a record book exercise for the Ownership Experience Program			
Complete a record book exercise for the Placement/Directed Lab Experience Program			

Lesson Topic/Objective (cont.)	Requires Math Skills		Time Spent Teaching Lesson
	Agree	Disagree	
UNIT: Orientation to Vocational Agriculture (cont.)			
Building the Supervised Occupational Experience Program			( ) hours
Distinguish between sound and unsound SOEP plans			
Determining Facilities for Obtaining Individual Work Experience			( ) hours
Prepare a financial plan for obtaining facilities			
Identify procedures for financing ownership programs			
Other _____			( ) hours
_____			
_____			
_____			
UNIT: Agricultural Leadership - No Objectives Identified			
Other _____			( ) hours
_____			
_____			
_____			
UNIT: Soil Science			
Physical Properties of Soil			( ) hours
Classify soil samples using the textural triangle as a guide			
Liming to Correct Soil Acidity			( ) hours
Formulate a liming schedule for various crops			

Lesson Topic/Objective (cont.)	Requires Math Skills		Time Spent Teaching Lesson
	Agree	Disagree	
UNIT: Soil Science (cont.)			
Organic and Inorganic Fertilizers Explain the fertilizer ratio of a 5-10-5 grade			( ) hours
Other _____ _____ _____ _____			( ) hours
UNIT: Environmental Protection - No Objectives Identified			
Other _____ _____ _____ _____			( ) hours
UNIT: Career Information - No Objectives Identified			
Other _____ _____ _____ _____			( ) hours
UNIT: Energy Conservation - No Objectives Identified			
Other _____ _____ _____ _____			( ) hours

Lesson Topic/Objective (cont.)	Requires Math Skills		Time Spent Teaching Lesson
	Agree	Disagree	
UNIT: Agricultural Mechanics			
Identification, Care, Storage, and Proper Use of Hand Woodworking Tools			( ) hours
Demonstrate the proper use of measuring and marking instruments			
Nails, Screws, and Fasteners			( ) hours
Calculate nail length			
Basic Mathematics in Carpentry			( ) hours
Describe the divisions of a ruler or tape			
Calculate square feet			
Describe the methods of determining lumber dimension			
Electrical Terms, Equipment, Meter Reading and Computation of Cost of KW Hours			( ) hours
Describe Ohm's Law			
Explain how electrical power is measured			
Explain how electrical energy is measured			
Project Planning			( ) hours
Calculate board feet			
Demonstrate the method for completing a bill of materials			
Cutting Rafters			( ) hours
Calculate the pitch of a roof			
Demonstrate laying out a common rafter			
Demonstrate the procedure for rafter ridge allowances and overhang			

Lesson Topic/Objective (cont.)	Requires Math Skills		Time Spent Teaching Lesson
	Agree	Disagree	
UNIT: Agricultural Mechanics (cont.)			
Other _____ _____ _____ _____			( ) hours
UNIT: Plant Science - No Objectives Identified			
Other _____ _____ _____ _____			( ) hours
UNIT: Animal Science			
Preparation of Rations Use the square method to balance a ration Other _____ _____ _____ _____			( ) hours ( ) hours

PLEASE WRITE ADDITIONAL LESSON TOPICS/OBJECTIVES CONCERNING MATH-RELATED INSTRUCTION THAT SHOULD BE PROVIDED THROUGH THE VOCATIONAL AGRICULTURE PROGRAM

PLEASE RETURN TO:

Jeffrey W. Moss
School of Vocational Education
Louisiana State University
Baton Rouge, LA 70803

THANK YOU FOR PARTICIPATING IN THIS STUDY

A P P E N D I X I I

Additional lesson topics/objectives containing math-related instruction that should be included in the Basic Program of Vocational Agriculture in Louisiana

IDENTIFICATION OF MATH-RELATED INSTRUCTIONAL OBJECTIVES IN THE BASIC PROGRAM OF VOCATIONAL AGRICULTURE IN LOUISIANA

ADDITIONAL LESSON TOPICS/OBJECTIVES CONCERNING MATH-RELATED INSTRUCTION THAT SHOULD BE PROVIDED THROUGH THE VOCATIONAL AGRICULTURE PROGRAM AS EXPRESSED BY THE SAMPLE GROUP.

Unit 1: Orientation to Vocational Agriculture

1. Technical writing for planning and experimentation
2. Determine the value of the livestock, crops, etc. in the parish
3. Calculating a garden
4. Sharing and investments, interest, and compounded interest
5. Minimum requirements for all students-garden or some horticulture experience
6. All problems would fall in the category of general math and not advanced

Unit 2: Agricultural Leadership

1. Budgeting for organizations
2. Conduct FFA meetings
3. FFA manual and student handbook
4. FFA-public law, vote counting, simple majority
5. FFA
6. Parliamentary law
7. FFA-parliamentary law, public speaking, and methods of voting
8. Officer's duties and responsibilities, public speaking, and parliamentary procedures
9. Public speaking, parliamentary law
10. Basic human relationships
11. Public law, vote counting, and 2/3 majority vote
12. Treasurer, secretary records, membership, fund raisers, etc.

Unit 3: Soil Science

1. Soil judging
2. Sampling, judging, etc.
3. Establishing rates for different crops
4. Calculating rates of application
5. Determine increases or decreases in production of crops due to fertilization
6. Calculating the ratio of fertilizer in a mix

Unit 4: Environmental Protection

1. Pesticides, herbicides, and insecticides

2. The big picture-farming, feeding, population, etc.
3. Calculating the soil run-off per acre of forest land
4. Measuring chemical amounts (1 tsp./gal.=5/5gal)
5. Fields available in agriculture
6. Chemical parts/million acceptable
7. Calculating rate of population growth
8. Toxicity ratings given in number to determine levels
9. Explain parts per million
10. Pesticides (uses, types, application, and pollution)
11. Uses and figuring pounds of fertilizer in analysis
12. Make-up of soil pH scale, soil types
13. pH cation exchange
14. Plant food uptake and computation
15. Rates/acre
15. Calculate number of pounds of fertilizer or lime needed in a given configuration to change a soil to meet a target set of characteristics
16. Problems to determine actual amounts per acre
17. Soil pH, land s/o slope-classification cation exchange
18. Protection of environment
19. Energy use-fuel consumption
20. Pesticides and FIFRA Laws
21. DNA
22. Atmosphere and weather information statistics
23. Calculate pollutants by percentage in water or soil sample
24. Pesticide application rates
25. Pesticide mixing and application rates
26. Working with chemical mixing and measurement
27. Not enough teachable materials available

Unit 5: Career Information

1. Fields available in agriculture
2. Financial advantages of different jobs
3. Figuring wages per hour-overtime
4. Salaries, cost of living, and daily expenses
5. Job opportunities-occupation and requirements
6. Identify areas of math orientation in agriculture/agri-business
7. Agriculture related occupations
8. Jobs available and placement

Unit 6: Energy Conservation

1. Calculating insulation; figuring electric bill
2. R-factors and square footage
3. Population growth versus natural resources and its ability to recover
4. Calculating amount of electricity used in a 2000 sq. ft. house with a 3 ton air conditioner
5. R-values; calculate R-values
6. Watts, amps, and kilowatt hours

7. Converting energy loss to number of kilowatt hours or BTU's wasted; converting to dollars
8. Calculating BTU requirements, heat loss areas, etc.
9. Energy saving concepts
10. Insulation requirements
11. Same as science
12. Conservation methods and practices
13. R-values of insulation; waste conservation, and percent loss
14. Insulation and energy conservation
15. Energy use-fuel consumption
16. Fuel consumption, electrical units
17. Calculate reflection function, resistance to electrical flow, amps, watts required, etc.
18. Saving energy in the home, on the farm, and in industry
19. Calculate energy ratings for appliances and types of insulating materials (Energy Computer program is excellent)
20. Electric bill
21. DNA

Unit 7: Agricultural Mechanics

1. Knowing calculations
2. Determine pistons displacement
3. Changing oil, cooling system maintenance-hydraulic oils, estimating time to cover ground with certain size implements
4. Applied physics in cutting/welding and movement of large projects and calculations
5. Small engines
6. Concrete mixtures
7. Paints and painting
8. Plumbing-irrigation
9. Surveying
10. Calculating cubic yards for concrete, calculate area for paint, roofing, siding
11. Sprayer calibrations for certain pesticides
12. Calculate angles on projects using trigonometry
13. Gardening-ratio-measurements
14. Concrete-cubic ft/yd. (slope for drainage)
15. Size of engines in cubic foot (volume measurements)
16. Welding, small engines, electrician, acetylene welding
17. Figuring concrete
18. Preparation of sprayer rates
19. Plumbing-length of pipe-elbows, tees, figuring concrete
20. Arc welding and acetylene cutting (measuring pipe and finding centers and diameters of shafts)
21. Concrete volume; plumbing-pipe measurement, welding measurement of metal, angles of welds
22. Horsepower and basic measure
23. Hydraulics, horsepower
24. Small engines, welding, electrician
25. Survey, land measurement, math in welding

26. Gear and pulley ratios, various PTO ratios and calibration of spray rigs and other farm application
27. Calculating the length of pipe, estimating materials for concrete, painting, roofing, etc.

Unit 8: Plant Science

1. Pasture and range
2. Calculate plant population; calibration of sprays
3. Temperature regulation in greenhouses; preparing greenhouse programs for delivery of finished product
4. Major function between plants and life animals
5. Plant part and ID, grass, weed and legume identification
6. Seeding rates
7. Calculating square foot and amount of plants used per square foot
8. Spacing greenhouse and garden plants used per square foot
9. Candlelight requirements for certain plants
10. Calculate seed, fertilizer, chemical amounts and dollars needed to raise crops in certain areas
11. Percentages of requirements in plant parts, etc.
12. One pH scale orientation-describe how it works, how to change it, soil test calculations and water test calculations
13. Application of pesticides-mixing rates, spray rig calibrations
14. Forestry, horticulture
15. Horticulture, greenhouse management
16. Row crop insect control
17. Basic plants and taxonomy
18. Cotton, soybean Scout Insect Control
19. Plant identification

Unit 9: Animal Science

1. Figuring gestation tables
2. Ration/gain
3. Calculating cost per pound, C W-etc. of beef, pork, lamb, calculating amount of seasoning per pound of meat
4. Using computer method to balance a ration
5. Show how a balanced ration would work much better than a non-balanced ration-lack of certain minerals-diseases of animals (causes and cures; showing monetary loss)
6. Figuring profit/loss; feed requirement per animal during feeding period; percent hatchability; weaning weight percentage
7. Calculate pounds of feed and money amount needed to feed pig, lamb, or steer to M/CT. Wt.
8. Percent breeding offspring rates; amount of feed required-profit margin of feed
9. Basic gain of animals on feed
10. Basic gain ratios for extended periods
11. Balance a ration properly for various uses

12. Reproduction, digestion, milk production, animal selection
13. Figuring profit of feed for a particular ration
14. Veterinary science (animal physiology, diseases and ways of administrating medicine)

OTHER RESPONSES

1. Most all of math is from general math category
2. Concrete and masonry (figuring cubic feet of concrete needed for jobs)
3. Reading a ruler
4. Measuring land
5. Calibration of spray equipment
6. Figure board feet in lumber
7. Figure volume of tanks, etc.
8. Forestry
9. Volume of standing timber (percentage)
10. Calculate loan payments
11. Determine costs in loans
12. Identify factors in purchasing home or land
13. Calculate timber stands
14. Calculate concrete needs
15. Calculate costs of feeding livestock and/or pets at home
16. Plumbing-measuring
17. Surveying
18. Use of computer programs designed to assist with management and financial trend analysis for production enterprises
19. Determining distance pacing
20. Determining BA standing timbers
21. Determining average daily gain and feed consumption
22. Forestry-tree production (number of trees per acre, fertilization per acre, wind direction and speed, relative humidity, dew point, to control fire) pulp and paper (calculate the percentage hardwood and softwood in a typical wood chip sample, determine the moisture content of wood chips)